UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

APR 18 2008

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Issues Regarding Class I Increment Analysis Inventories

FROM: Dennis Atkinson, Meteorologist
Model Clearinghouse Director, C439-01

TO: Jeff Robinson, Chief
Air Permits Section (6PD-R)

THRU: Tyler Fox, Leader
Air Quality Modeling Group, C439-01

## INTRODUCTION

In response to your memo of April 18, 2008, the Model Clearinghouse has reviewed your proposed resolution of the issues presented, in order to properly and adequately account for cumulative impacts of emissions from all increment affecting sources in the Class I increment analysis associated with the proposed Prevention of Significant Deterioration (PSD) permit for AEP SWEPCO John W. Turk, Jr. power plant in Hempstead, AR. Recognizing the difficulty of the situation presented by the applicant's exclusion of a significant number of increment affecting sources from the original dispersion modeling analysis, we concur with your assessment of the key technical and guidance issues raised and with the general approach presented in your submittal in addressing this application.

## BACKGROUND

The original Class I increment analysis submitted by AEP SWEPCO indicated numerous increment exceedances for 24-hour $SO_2$ at the Caney Creek Class I Wilderness Area, but the proposed source was less than the EPA proposed Class I significant impact level (SIL) for $SO_2$ on the high, second high (H2H) days at each violating receptor. EPA Region 6 commented in July 2007 and again in April 2008 that the applicant had inappropriately excluded increment-contributing sources. As a result of this exclusion, the modeled impacts from the original increment inventory did not provide sufficient information to conclude that the applicant did not cause or contribute to exceedances of the $SO_2$ increment in Caney Creek already identified in their previous modeling submittal, or potential exceedances that may occur on additional days due to cumulative impacts from excluded sources.

After reviewing the increment inventory data files provided by the applicant, it was apparent that the applicant had eliminated several hundred sources from Arkansas, Louisiana, Oklahoma, and Texas. Subsequent discussions with the applicant revealed that they had used an emissions over distance (Q/D) approach to eliminate increment consuming sources from their final modeled inventory (a Q/D value of less than 20 was used as a threshold to exclude sources, with Q in TPY and D in kilometers). Cursory review of the emissions total of the sources eliminated from the original modeled inventory indicated that a majority of the emissions reside in the same general area upwind of the Class I area as the source currently under permit review. Since there were a number of additional modeled impacts that were within 5%-10% of the 24-hour $SO_2$ increment level, Region 6 expressed a concern regarding the potential that the applicant could contribute significantly to additional increment exceedance periods that would not have been identified due to the elimination of those sources from the increment inventory. Based on these concerns, Region 6 requested that the applicant resubmit the Class I increment modeling including all increment affecting sources, pursuant to Section 7.2.1(a) of 40 CFR Part 51, Appendix W, hereafter referred to as the *Guideline on Air Quality Models* (or *Guideline*). In response to the request from Region 6 to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated from the additional modeled increment inventory.

CLARIFICATION OF RELEVANT GUIDANCE

We concur with your assessment that the key issue of concern in this case is the requirement, clearly stated in Section 7.2.1.1(a) of the *Guideline,* to include impacts from all increment-contributing sources in an analysis of impacts on PSD increments. The full text of the relevant paragraph is quoted here for reference:

> "7.2.1.1 Design Concentrations for $SO_2$, PM– 10, CO, Pb, and $NO_2$
>
> a. An air quality analysis for $SO_2$, PM–10, CO, Pb, and $NO_2$ is required to determine if the source will (1) cause a violation of the NAAQS, or (2) cause or contribute to air quality deterioration greater than the specified allowable PSD increment. For the former, background concentration (subsection 8.2) should be added to the estimated impact of the source to determine the design concentration. **For the latter, the design concentration includes impact from all increment consuming sources.**" [emphasis added]

This paragraph makes a clear distinction between the requirements of air quality analyses for compliance with the NAAQS as opposed to PSD increments. For NAAQS compliance modeling, a further distinction is made between estimated impacts from the source under review and background concentrations which need to be added to the source's impact for comparison to the NAAQS. Reference is made to Section 8.2 for further guidance regarding the estimation of background concentration. Table 8.2 in Section 8.1 addresses the emission input requirements for NAAQS compliance demonstrations, and distinguishes between the proposed source, "nearby source(s)", and "other source(s)". A footnote to Table 8.2 indicates that impacts from the latter category can often be represented by an appropriate determination of the "background concentration" from an analysis of monitored ambient air quality data. Section 8.2.3(b) provides

the following criterion for determination of which sources to include in a NAAQS modeling analysis:

> "8.2.3 Recommendations (Multi-Source Areas)
>
> b. Nearby Sources: All sources expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration for emission limit(s) should be explicitly modeled."

Our purpose in citing the sections of the *Guideline* related to requirements for NAAQS compliance demonstrations is to emphasize the clear distinction between the requirements for the emissions inventory needed for NAAQS compliance as opposed to PSD increment compliance. Procedures that may be applicable to determining which sources need to be explicitly modeled for NAAQS compliance cannot be applied for PSD increment compliance inventories. There is nothing comparable to the "monitored background" component typically included in a NAAQS demonstration for PSD analyses, and no technical or regulatory basis for "screening out" or otherwise excluding impacts from increment affecting sources from a cumulative (net) increment analysis.

As noted in your submittal, we also recognize the potential computational challenge of modeling a very large number of sources that may be identified as increment affecting sources, especially across a large domain that may be required for demonstrating compliance with the increments for a distance Class I area using the CALPUFF modeling system. In such situations, we believe it is appropriate and consistent with the *Guideline* to utilize a combination of screening and refined modeling techniques as a more efficient method to estimate the cumulative contribution to increment than to include all sources in the refined modeling analysis. Section 4.2.1.1(a) of the *Guideline* states that *"Where a preliminary or conservative estimate is desired, point source screening techniques are an acceptable approach to air quality analyses."* Section 4.2.1.1(b) further stipulates that *"Agreement should be reached between the model user and the appropriate reviewing authority on the choice of the screening model for each analysis, and on the input data as well as the ultimate use of the results."*

MODEL CLEARINGHOUSE RECOMMENDATION

As stated in the Introduction, we concur with your assessment of the key technical and guidance issues raised and with the general approach presented in your submittal to address this application. Although the exclusion of a significant number of sources from the original increment modeling analysis does not conform with the *Guideline* and presents a difficult situation to resolve, we agree that a reasonable and technically sound approach to provide additional assurance that the proposed source will not contribute significantly to potential PSD increment violations is feasible and can be justified for this specific case based on the information available. The most direct option to resolve the issue, which would not require any further justification by the applicant or review by the Clearinghouse, would be to perform additional refined modeling of the increment-consuming sources excluded from the original analysis to complete the impact assessment. Short of that more direct approach to resolve the issue, some mix of refined and screening-level estimates is the only alternative, provided that an

acceptable level of justification and assurance can be given that the final assessment will be protective of air quality levels.

The *Guideline* references several existing screening techniques, for both simple and complex terrain applications. However, the use of an emission/distance ratio (Q/D) as a screening technique is not addressed in the *Guideline*, and we will not address its use as a screening technique in a generic sense with this response. Our review and concurrence with your proposal merely acknowledges that use of a Q/D threshold as a tool to identify which sources to explicitly account for in the refined modeling vs. sources to be accounted for in an aggregate sense, based on the inclusion of pseudo-sources within the refined modeling, is technically reasonable given the specific circumstances of this case.

We concur with your conclusions, based on an analysis of backward trajectories to determine air mass histories on days that exceeded, that the focus for including impacts from additional sources beyond 50 km from the Class I area can be limited to the 90º sector focused on transport from the south, including the proposed facility. We see no benefit to further supplementing the inventory for sources beyond 50 km from the Class I area and outside the 90º sector. However, we also want to emphasize that such a determination could not have been made *a priori*, and can only be justified in this specific case based on the information available from the original incomplete modeling analysis.

This concurrence by the Model Clearinghouse is limited solely to this application. If you have any further questions or comments, please contact Dennis Atkinson at (919) 541-0518 or Tyler Fox at (919) 541-5562.

cc: Roger Brode, C439-01
Mark Evangelista, C439-01
Tyler Fox, C439-01
Bill Harnett, C504-01
Michael Ling, C504-01
Raj Rao, C504-03
Richard Wayland, C304-02
Regional Modeling Contacts

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

APR 1 8 2008

MEMORANDUM

SUBJECT: Proposed Screening Technique for Class I Increment Analysis

FROM: Adina Wiley, Environmental Engineer (6PD-R)

Erik Snyder, Lead Regional Modeler (6PD-L)

Jeff Robinson, Chief
Air Permits Section (6PD-R)

TO: Dennis Atkinson, Model Clearinghouse Coordinator
Air Quality Modeling Group

This memo seeks your concurrence with Region 6's intent to accept a screening technique (with the inclusion of emissions from screened-out sources included in the modeling as a few pseudo sources) for the Class I increment analysis associated specifically with the proposed Prevention of Significant Deterioration (PSD) permit for AEP SWEPCO John W. Turk, Jr. power plant in Hempstead, AR. This screening technique will be used to augment the existing modeled Class I increment inventory submitted in January 2007.

BACKGROUND

The original Class I increment analysis submitted by AEP SWEPCO indicated numerous increment exceedances for 24-hour $SO_2$ at the Caney Creek Class I Wilderness Area, but the proposed source was less than the EPA proposed Class I significant impact level (SIL) for $SO_2$ on the high, second high (H2H) day at each violating receptor. EPA Region 6 commented in April 2007 and again in July 2007 that the applicant had inappropriately excluded increment-contributing sources and that the modeled impacts from the original increment inventory did not provide sufficient information to conclude

that the applicant did not cause or contribute to exceedances of the $SO_2$ increment in Caney Creek already identified in their previous modeling submittal, or potential exceedances on additional days due to cumulative impacts from excluded sources. Our regulatory interpretation is that removal of increment consuming sources without consideration of their potential contribution to an increment impact analysis is prohibited under Section 7.2.1.1(a) of 40 CFR Part 51, Appendix W (*Guideline on Air Quality Models ("Guideline")*).

To develop a more comprehensive understanding of the modeled increment exceedances in Caney Creek, we conducted an air mass history analysis of the CALPUFF modeling results for days when the modeled $SO_2$ levels were within 10% and greater of the 24-hour $SO_2$ increment. Using NOAA's HYSPLIT model, backward trajectories relative to the Caney Creek Class I area were run four times a day for all days at or above 90% of the 24-hour $SO_2$ increment. Air mass history maps were generated using a computer program developed by EPA Region 7. The maps indicate the probability of an air mass passing over a particular region prior to arrival. Used in this context, the air mass history maps provide an indication of potential source regions on days when the modeled $SO_2$ increment is near or exceeds allowable levels. The air mass history maps indicate two significant areas of potential influence on the high days in Caney Creek. The area of highest probability extends predominantly south from Caney Creek towards eastern Texas and Western Louisiana. This area is in the same general area as the proposed AEP source upwind of the Class I area. Previous PSD modeling for the Western Farmers Hugo Unit 2 in Oklahoma also identified this area as an area of concern for days near or above the 24-hour $SO_2$ increment, reinforcing the necessity to adequately capture potential increment impacts from sources that lie within that region.

After reviewing the increment inventory data files provided by the applicant, it was apparent that the applicant had eliminated several hundred sources from Arkansas, Louisiana, Oklahoma, and Texas. Subsequent discussions with the applicant revealed that they had used an emissions over distance (Q/D) approach to eliminate increment consuming sources from their final modeled inventory (a Q/D value of less than 20 was used as a threshold to exclude sources, with Q in tons per year (TPY) and D in kilometers). We were aware of additional large $SO_2$ sources that should have been included in the modeled inventory. These sources are in the same upwind air mass as the proposed source. Cursory review of the emissions total of the sources eliminated from the original modeled inventory indicates that a majority of the emissions reside in the same general area upwind of the Class I area as the source currently under permit review. Since there were a number of additional modeled impacts that were within 5%-10% of the 24-hour $SO_2$ increment level, we believed that this created the potential that the applicant could contribute significantly to additional increment exceedance periods that would not have been identified due to the elimination of those sources from the increment inventory. We requested that the applicant resubmit the Class I increment modeling including all sources, pursuant to Appendix W, section 7.2.1.1(a).

In response to our request to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated

from the modeled increment inventory. We continue to believe that it is inappropriate to use screening techniques to eliminate sources from the modeled increment inventory. However, we also recognize the unique computational challenge this may create with explicitly modeling several hundred sources for the three simulation years using the CALPUFF modeling system. Therefore, while we continue to believe it inappropriate to eliminate sources from the model increment inventory, we believe that screening techniques can be used in this case to provide a preliminary and conservative estimate of the impact of more distant sources in a cumulative increment analysis without the necessity of explicit characterization of such sources in a refined modeling application.

EPA Region 6 Evaluation

The most correct method from both a technical and regulatory perspective should have been to include impacts from all increment affecting sources (both consuming and expanding sources), rather than using screening techniques to eliminate the impacts of some sources from an inventory. However, recognizing the potential computational challenge of modeling several hundreds sources for three simulation years with the CALPUFF modeling system, we believe it should be possible to utilize a combination of screening and refined modeling techniques to estimate the cumulative contribution to increment. Exceedances of the 24-hour $SO_2$ increment have already been identified by previous modeling; therefore, EPA Region 6 seeks to implement a method to account for the potential impacts of increment consuming sources, but to focus the inclusion of the additional increment affecting sources to areas that our analysis indicates a higher potential for cumulative impact with the current source under review.

Region 6 evaluated the following options:

1. An emissions over distance (Q/D) screening methodology developed by the United States Forest Service (USFS) and National Park Service (NPS). According to applicant, the USFS/NPS screening methodology has been used in PSD permitting actions in EPA Regions 3 and 9. In the FLM screening methodology, the source emission rate is divided by the distance to the Class I area. If the ratio is greater than 0.8 for $SO_2$, then the source is included in the cumulative increment analysis.

2. A Chi-Over-Q technique developed by the applicant using the existing increment inventory to establish a basis for determining impact from non-modeled sources. Chi, the predicted concentration for the existing source, is divided by the emission rate Q for the existing source. This analysis is completed for all sources in the inventory; 69 sources in this instance. The $\chi/Q$ values are then plotted as a function of distance from Caney Creek and best-fit linear and power law equations are generated. These equations can be used to estimate the emission rates that generate an impact above the proposed Class I SIL for 24-hour $SO_2$.

3. All major and minor sources within a 50 km radius of the Class I area would be included if facility emissions were greater than 2 lb/hr. Outside of the 50 km radius, a 90° degree sector can be established to bracket the geographic area identified in our

air mass history analysis. All identified sources within the area encompassed by the 90° sector would then be added into the existing increment inventory for further analysis when the facility (all sources at one facility) exceeded a 2 lb/hr emission level. The proposed AEP facility is located near the middle of this sector, so this analysis would likely assess if the proposed source could significantly contribute to an increment violation.

SUMMARY OF ISSUE AND PROPOSED RESOLUTION

Region 6 recognizes that Appendix W requires all increment consuming and expanding sources be included in an increment analysis. The proposed approach is a tiered process related to distance and wind sector that will be used in addition to the existing $SO_2$ increment inventory of 44 sources. The focus will be to augment the inventory with emissions for additional sources with a greater probability of contributing to a cumulative impact with the current source under review.

Region 6 proposes that all sources within a 50 km radius of the Class I area, regardless of size, are to be explicitly modeled (including one large minor source 57 km north of the Class I area). Explicitly modeling all sources within 50 km accounts for the potential influence of recirculating wind patterns on cumulative impacts.

Outside of the 50 km radius, but within the 90-degree sector (centered south of the Class I area), a Q/D threshold of 0.8 will be used to identify the additional sources on a facility-wide basis that will be explicitly modeled (with Q expressed in TPY and D in km). The total facility $SO_2$ emission rate will be used in the Q/D analysis; facilities with a Q/D ratio greater than 0.8 will be explicitly modeled. Facilities less than or equal to 0.8 will be grouped and modeled as pseudo-point source(s) to generate a conservative screening-level estimate. The pseudo-point source location(s) will be determined after examining the locations and characteristics of the facilities below the Q/D threshold. Sources below the threshold will be grouped first based on their location from the Class I area; initial groups will be based on discrete distance bands from the Class I area. Within these distance bands, the pseudo source characteristics will be determined from the facility-wide $SO_2$ emission rates from the screened sources. A facility-wide $SO_2$ emission rate of 40 TPY or less will characterized as a low-level (height above ground) source; an emission rate of 40-250 TPY $SO_2$ will be a mid-level source; and an emission rate greater than 250 TPY will be a high-level source.

Once the additional sources are included in the increment inventory as described above, either explicitly or as pseudo-sources, the permit applicant will need to reassess increment consumption at the Caney Creek Class I Wilderness Area. For each predicted increment violation, the applicant must demonstrate that the proposed source is below the proposed 24-hour $SO_2$ Class I significant impact level for the permitting process to proceed.

Requested Action Items:

Please review our interpretation of Section 7.2.2.1 (a) of the *Guideline* as it relates to this project. Please also clarify if our proposed procedures are technically justified and consistent with guidance.

Region 6 believes that the 90-degree sector analysis as described above is the most technically defensible compromise option in this situation as it is most consistent with Appendix W requirements to account for impacts from all sources, but will target the additional modeling effort on the area of potential contribution of the proposed source, which also coincides with the main area of concern identified by the previous Hugo, OK Class I analysis.

Please call either Erik Snyder at 214-665-7305 or Adina Wiley at 214-665-2115 if you have any questions or need further information on this issue.

cc: Tyler Fox, OAQPS AQMG

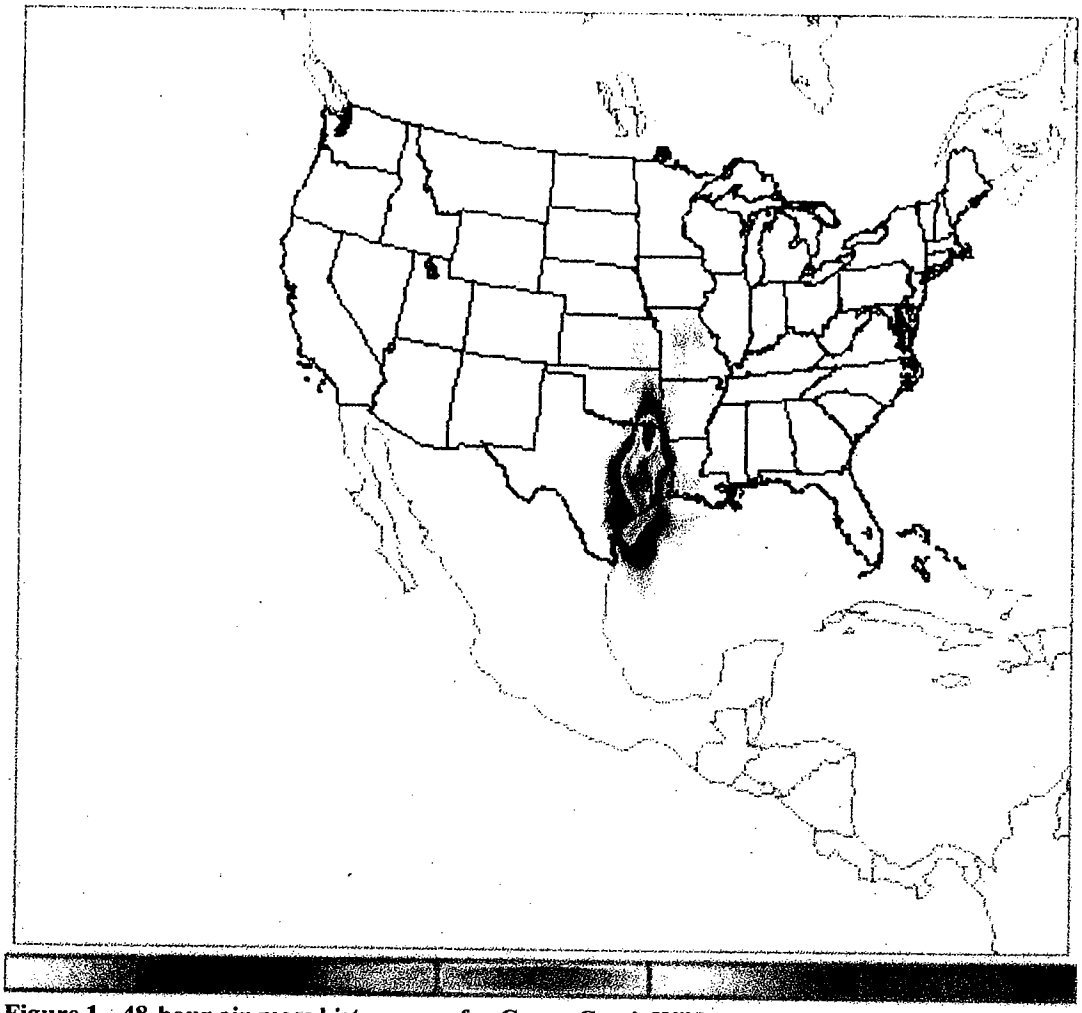

**Figure 1 - 48-hour air mass history map for Caney Creek Wilderness Area during periods when modeled $SO_2$ is greater than or equal to 90% of the 24-hour $SO_2$ increments. Due to map projection differences, the air mass history is shifted to the West compared to the actual location of the Caney Creek Wilderness.**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OCT 01 2008

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

**MEMORANDUM**

**SUBJECT:** Clarification of Region 6 Clearinghouse Request on "Proposed Screening Technique for Class I Increment Analysis"

**FROM:** Richard A. Wayland, Director
Air Quality Assessment Division (C304-02)

**TO:** Jeff Robinson, Chief
Air Permits Section (6PD-R)

The purpose of this memorandum is to provide clarification on language in the April 18, 2008 memo from Region 6 to our Model Clearinghouse for concurrence on their proposed screening techniques for Class I increment analysis. Based on review of the Region 6 memo by EPA's Office of General Council (OGC), it is necessary to provide these clarifications to be consistent with guidance in EPA's *Guideline on Air Quality Models* ("*Guideline*"), published as Appendix W to 40 CFR Part 51, and current interpretation of that guidance by OGC. We are therefore providing the language changes outlined below to the Region 6 memo to ensure this consistency with the Guideline.

The first clarification relates to the characterization by Region 6 of requirements under the Guideline contained in the first paragraph of their "Background" section, i.e.,

> "Our regulatory interpretation is that removal of increment consuming sources without consideration of their potential contribution to an increment impact analysis is prohibited under Section 7.2.1.1(a) of 40 CFR Part 51, Appendix W (*Guideline on Air Quality Models* ("*Guideline*"))."

The review by OGC necessitates the following language change:

> "Our understanding is that removal of sources in the affected areas from an emissions inventory without consideration of their potential contribution to an increment impact analysis is inappropriate under Section 7.2.1.1(a) of 40 CFR Part 51, Appendix W (*Guideline on Air Quality Models* ("Guideline")). This provision establishes the objective to include the impact of all increment consuming sources in the design concentration."

The second clarification relates to the fourth paragraph of their "Background" section, i.e.,

> "In response to our request to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated from the modeled increment inventory. We continue to believe that it is in appropriate to use screening techniques to eliminate sources from the modeled increment inventory. However, we also recognize the unique computational challenge this may create with modeling several hundred sources for the three simulation years using the CALPUFF modeling system. Therefore, while we continue to believe it inappropriate to eliminate sources from the model increment inventory, we believe that screening techniques can be used to provide a preliminary and conservative estimate of the impact of more distant sources in a cumulative increment analysis without the necessity of explicit characterization of such sources in a refined modeling application."

The review by OGC necessitates the following language change:

> "In response to our request to include all increment-contributing sources, the applicant proposed the use of an alternative approach to identify sources to be eliminated from the modeled increment inventory. We generally believe that it is inappropriate to use screening techniques to eliminate sources from the modeled increment inventory. However, we also recognize the unique computational challenge this may create with modeling several hundred sources for the three simulation years using the CALPUFF modeling system. Therefore, we believe that screening techniques can be used to provide a preliminary and conservative estimate of the impact of more distant sources in a cumulative increment analysis without the necessity of explicit characterization of such sources in a refined modeling application."

The third, and final, clarification relates to the first paragraph of their "EPA Region 6 Evaluation" section, i.e.,

> "The most correct method from both a technical and regulatory perspective should have been to include impacts from all increment affecting sources (both consuming and expanding sources), rather than using screening techniques to eliminate the impacts of some sources from an inventory. However, recognizing the potential computational challenge of modeling several hundreds sources for three simulation years with the CALPUFF modeling system, we believe it should be possible to utilize a combination of screening and refined modeling techniques to estimate the cumulative contribution to increment. Exceedances of the 24-hour $SO_2$ increment have already been identified by previous modeling; therefore, EPA Region 6 seeks to implement a method to account for the potential impacts of increment consuming sources, but to focus the inclusion of the additional increment affecting sources to areas that our analysis indicates a higher potential for cumulative impact with the current source under review."

The review by OGC necessitates the following language change:

> "The preferred method from both a technical and regulatory perspective is to include emissions from all sources in the affected area (both increases and decreases) rather than using screening techniques to eliminate the emissions of some sources from an inventory. However, recognizing the potential computational challenge of modeling several hundred sources for three simulation years with the CALPUFF modeling system, we believe it is possible to utilize a combination of screening and refined modeling techniques to estimate the cumulative contribution to increment from all sources in the area. Exceedances of the 24-hour $SO_2$ increment have already been identified by previous modeling; therefore, EPA Region 6 seeks to implement a method to account for the potential impacts of all sources in the area, but to focus the explicit characterization of source emissions to areas where our analysis indicates a higher potential for cumulative impact with the current source under review."

This memorandum will be added to the Model Clearinghouse record along with the original request memo from Region 6 and the OAQPS model clearinghouse response memo.

cc: Bill Harnett
Tyler Fox
Raj Rao
Michael Ling
Roger Brode